

**Appendix 1—Review of Historical (1974–2003)
Water-Quality Data**

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Since about 1974 the U.S. Geological Survey (USGS) has analyzed water-quality samples collected intermittently from streams, springs, and wells in the Barton Springs segment of the Edwards aquifer, primarily as part of a long-term monitoring program in cooperation with the City of Austin. Considerable variability exists among the selection of sampling sites, methods of analysis, and objectives of sampling, which limits comparability of the data. Nonetheless, these data provide a broad understanding of historic aquifer water quality and are summarized in this appendix.

Major Ions

Geochemical variability in ground water in the Barton Springs segment is mostly accounted for by residence time, flow path intersection, episodic influxes of surface water, and contribution from the saline zone and Trinity aquifer (Garner and Mahler, 2006). Wells with samples that show a statistically significant negative correlation with streamflow or aquifer flow condition can be interpreted as intersecting major or minor flow paths in the aquifer. The major ion geochemistry in samples from some wells in the Barton Springs segment is influenced by an influx from the saline zone, particularly when aquifer flow conditions are low; the major ion geochemistry in other wells appears to be affected by upward leakage from the Trinity aquifer, particularly when aquifer flow conditions are high. Major ion data for wells in the Barton Springs segment are in Garner and Mahler (2007).

Samples collected during 1978–99 from the Main Spring orifice generally indicate a calcium-magnesium-bicarbonate ground-water type (complete historical major ion data for springs and streams are in appendix 2). Some samples were relatively enriched in sodium, chloride, and sulfate, extending toward a geochemical composition typical of water from the saline zone (fig. 1.1). Much of the variability in the major ion geochemistry was related to aquifer flow conditions. Concentrations of some major ions and molar ratios vary with spring discharge. On the basis of 94 samples collected from Main Spring during 1978–99 under a range of aquifer flow conditions, sodium, chloride, and sulfate concentrations were inversely proportional to discharge for low spring discharge but showed no relation to discharge for average to high spring discharge (fig. 1.2). These characteristics indicate mixing of two endmembers, one of which has been proposed to be water from the saline zone (Slade and others, 1986; Smith and Hunt, 2004), which has elevated concentrations of sodium, chloride, and sulfate, and the other of which is “average” Edwards aquifer water. At a spring discharge threshold of about 40 cubic feet per second, as determined by regression (D.A. Johns, City of Austin, written commun., 2006), the contribution from the saline zone appears to become negligible.

Nitrate

Historical data on nitrate nitrogen concentrations in samples collected from 26 wells in the Barton Springs segment during 1978–2003 have been analyzed (Garner and Mahler, 2007). Maximum nitrate concentrations were 1.7 milligrams per liter (mg/L) or less in 17 of the 26 wells. The remaining nine wells appeared to be affected by localized sources of nitrate. For example, for well KCH (table 1.1), with the highest nitrate concentrations (3.8 to 8.6 mg/L, n=35) of all wells analyzed, a nearby historic ranching operation might be a source of excess nitrate. Two wells located along the eastern saline zone boundary had very low nitrate concentrations (less than 0.1 mg/L), and denitrification was identified as a possible cause of these low concentrations. Data for nitrate in wells are in Garner and Mahler (2007), and data for nutrients in springs and streams are in appendix 2.

Soluble Pesticides

Twenty-eight water-soluble pesticides were detected in samples collected intermittently from springs, streams, and wells during 1975–2005 (tables 1.1, 1.2; complete data in appendix 2). Twenty-five pesticides were detected in samples from streams, six in samples from springs, and eight in samples from wells. Atrazine, diazinon, prometon, and simazine were detected in samples from all three types of sites (table 1.2); along with carbaryl, these five compounds account for 74 percent of all detections (fig. 1.3). Concentrations of pesticides were generally low: 75 percent of all pesticide concentrations were less than 0.1 microgram per liter ($\mu\text{g/L}$) (fig. 1.4). Atrazine had the largest number of concentrations equal to or greater than 0.1 $\mu\text{g/L}$.

Pesticides in Surface Water

Major recharging streams of the Barton Springs segment were sampled intermittently during 1978–2003, using a variety of sampling and analytical techniques. Broadly, this surface-water sampling comprised two phases. During 1978–2001, grab samples were collected from Barton, Onion, Slaughter, Bear, and Williamson Creeks under a range of hydrologic conditions. Despite the small number of analyzed pesticides and higher laboratory reporting levels (mostly 0.1 $\mu\text{g/L}$ or higher) for this sampling period, several pesticides were detected. Consequently, these results are considered in detail in this section. During 2002–03, flow-weighted composite samples were collected from Barton and Williamson Creeks during stormflow conditions;

1-4 Recent (2003–05) Water Quality of Barton Springs, Austin, Texas, With Emphasis on Factors Affecting Variability

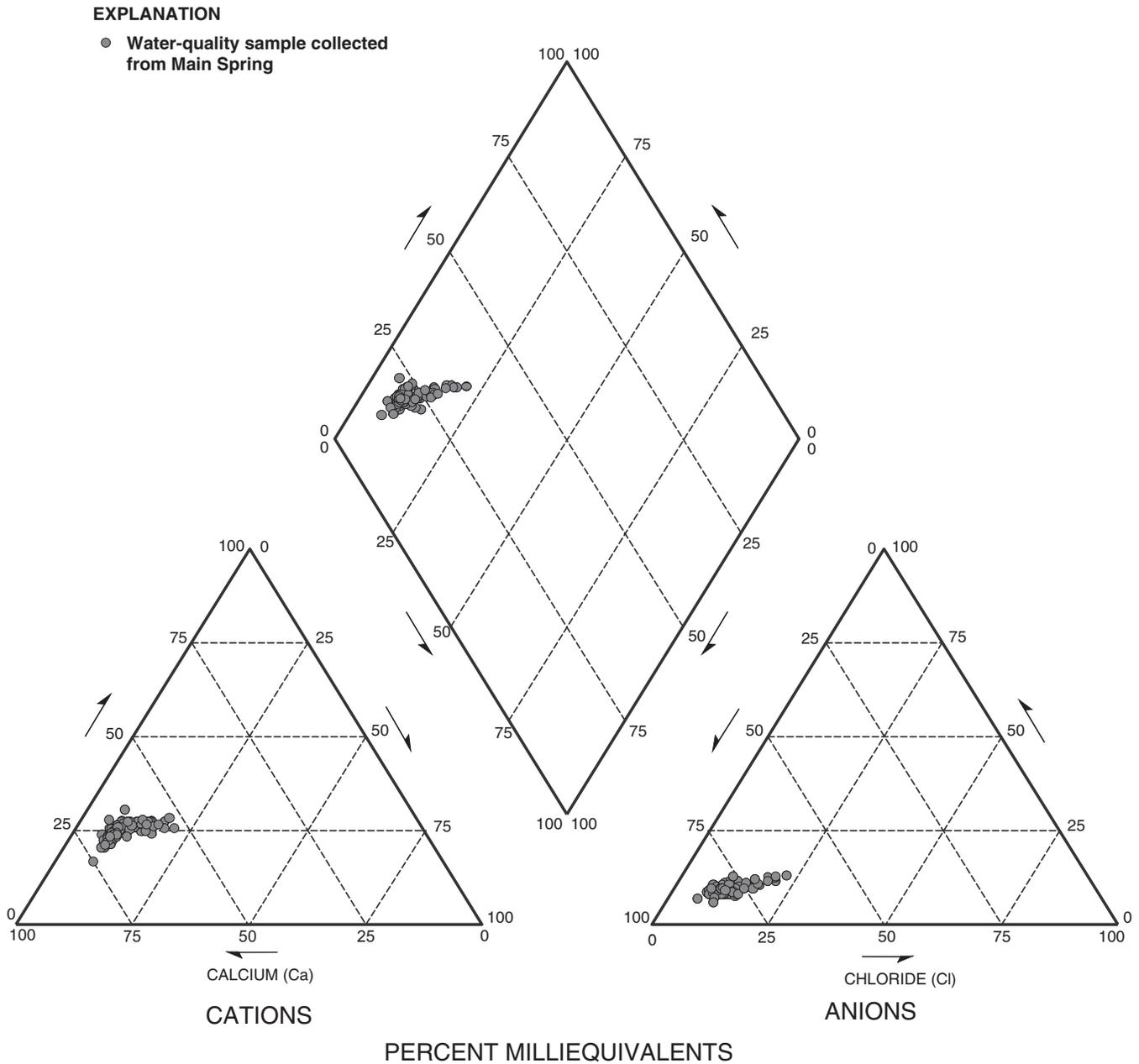


Figure 1.1. Piper diagrams showing geochemical composition of historical samples from Main Spring, Austin, Texas (station 08155500 Barton Springs at Austin, Tex.).

these samples were analyzed using lower reporting levels (as low as 0.001 $\mu\text{g/L}$), and there were numerous detections among the set of 89 analyzed pesticides. These samples also are discussed in this section.

Twelve pesticides were detected in samples collected during 1978–2001 from each of the five sampled streams. Sixty-three samples were collected from five sites along Barton Creek, and 25 percent of these samples had at least one detection of at least one of the following 11 pesticides: atrazine, 2,4-D, bromacil, carbaryl, chlorpyrifos, diazinon, hexazinone, malathion, metolachlor, prometon, and simazine. Forty-two samples were collected from two sites along Williamson Creek during 1978–85; 74 percent of these samples had at least one detection of at least one of seven pesticides: atrazine, 2,4,5-T, 2,4-D, diazinon, malathion, prometon, and simazine, all of which also were detected in Barton Creek except for 2,4,5-T. Forty-six samples were collected from Onion, Slaughter, and Bear Creeks during 1978–83; 22 percent of these samples had at least one detection of one of four pesticides: 2,4-D, 2,4,5-T, diazinon, and prometon.

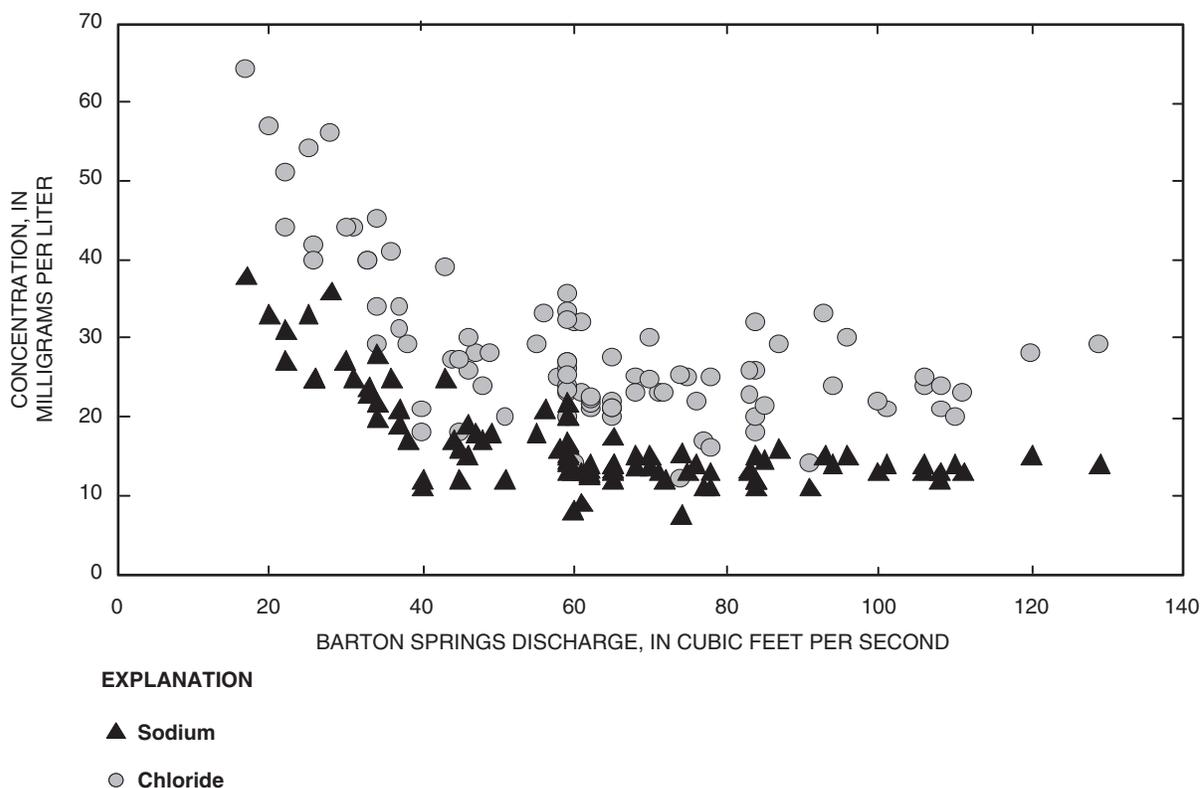


Figure 1.2. Sodium and chloride concentrations in historical samples collected from Main Spring, Austin, Texas (station 08155500 Barton Springs at Austin, Tex.).

Eleven stormflow composite samples were collected from Barton and Williamson Creeks during 2002–03. Of the 22 pesticides detected in these samples (table 1.2), atrazine, carbaryl, and diazinon were the most frequently detected. Pesticide detections in composite samples collected from streams after August 2003 are discussed elsewhere in this report.

Concentrations of five pesticides increased from upstream to downstream reaches in Barton Creek for the same storms, and concentrations of three additional pesticides detected at the upstream end were not detected at the downstream end (fig. 1.5). This assessment is made on the basis of seven flow-weighted composite samples collected from Barton Creek following storms in 2002. Median concentrations of atrazine, benomyl, diazinon, fipronil, and simazine increased from upstream to downstream, and median concentrations of carbaryl, fluometuron, and siduron decreased from upstream to downstream.

Pesticides in Spring Water

During 1978–2003, pesticide samples were collected from the four spring orifices of Barton Springs. Sampling during 1978–81 was at Main Spring only; the analytical method included only four soluble pesticides and had a reporting level of 0.01 $\mu\text{g/L}$ or higher; there was only one detection in this data set (diazinon at 0.03 $\mu\text{g/L}$). Sampling at Main Spring orifice continued during 1981–91, and the method included 14 to 15 pesticides with similarly high reporting levels; again, there was only one detection (prometon at 0.1 $\mu\text{g/L}$). During continued sampling at Main Spring orifice during 1991–93, 36 to 42 pesticides were analyzed, and there were no detections. The small number of detections in samples during 1978–93 likely is related to both the small number of analyzed compounds and high reporting levels (as high as 5 $\mu\text{g/L}$). During 2000–2003, all four spring orifices of Barton Springs were sampled after one or more rainfall events, and 47 pesticides were analyzed with reporting levels as low as 0.001 $\mu\text{g/L}$. As the much lower reporting levels resulted in many more detections, only results from the 2000–2003 sampling are discussed and summarized here.

1-6 Recent (2003–05) Water Quality of Barton Springs, Austin, Texas, With Emphasis on Factors Affecting Variability

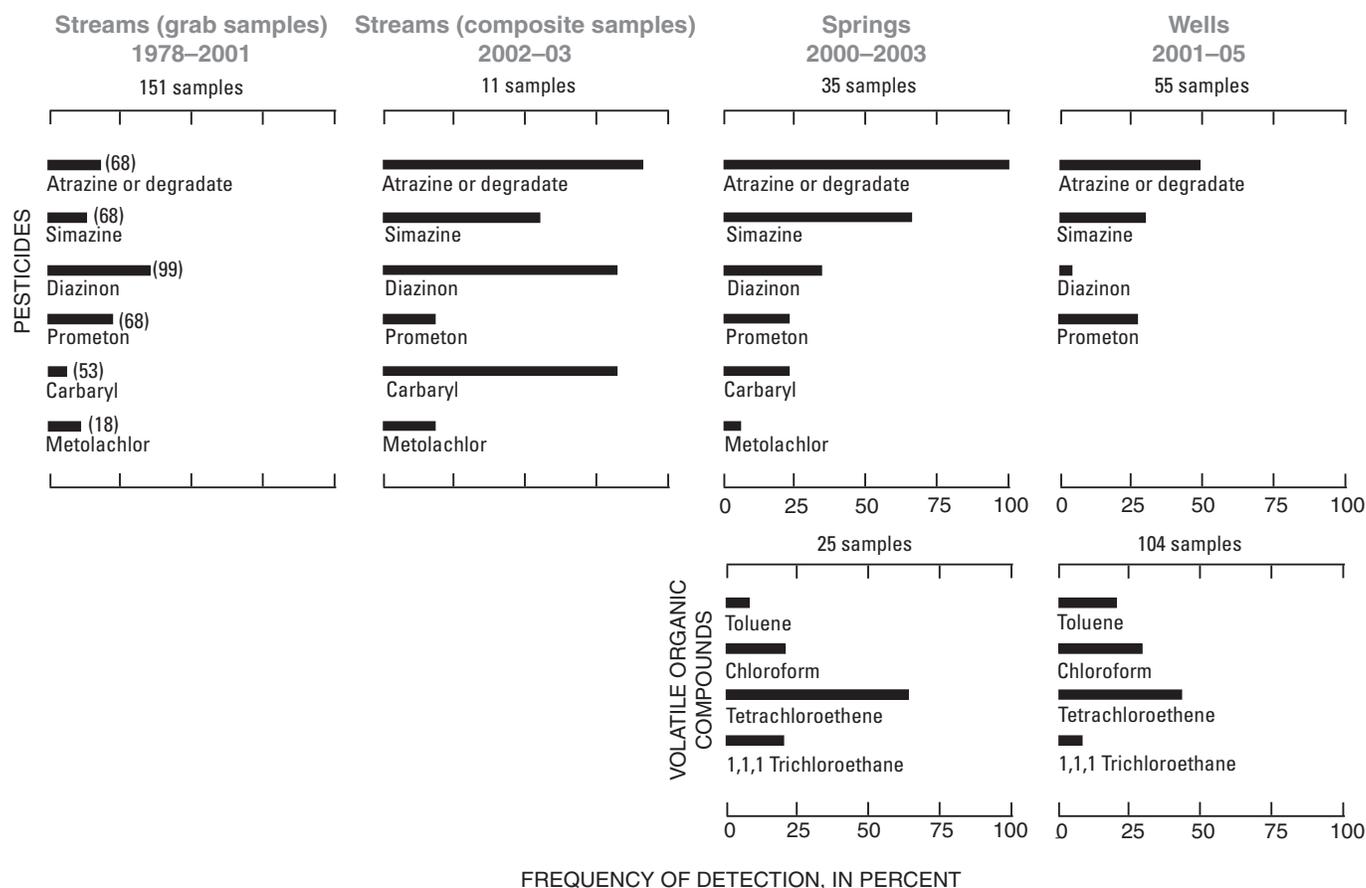


Figure 1.3. Frequency of detection of the most frequently detected pesticides and volatile organic compounds in historical samples collected from streams, springs, and wells in the Barton Springs segment of the Edwards aquifer, Texas.

Six pesticides were detected in samples collected from Barton Springs during 2000–2003 (table 1.2). Concentrations in spring-water samples collected after rainfall varied considerably; for example, atrazine concentrations increased by a factor of about 75 after a rainfall event in May 2000 (Mahler and Van Metre, 2000). Pesticide concentrations in samples from Upper Spring generally were higher than concentrations in samples from Main, Eliza, or Old Mill Springs; the maximum atrazine and diazinon concentrations in Upper Spring samples (3.2 and 0.1 $\mu\text{g/L}$, respectively) were about 5 times higher than maximum concentrations in samples from the three other springs (0.6 and 0.02 $\mu\text{g/L}$, respectively). Atrazine was detected in every sample collected from every spring during 2000–2003.

Pesticides in Ground Water

During 1978–81, nine wells were sampled and analyzed for a small number of soluble pesticides; during 2001–05 samples were collected from 11 wells and analyzed for 89 pesticides. During the 1978–81 sampling period, the analytical method included only four water-soluble pesticides and a reporting level of 0.01 $\mu\text{g/L}$ or higher for all compounds; there were only two detections in this data set (diazinon at 0.01 and 0.04 $\mu\text{g/L}$). During 2001–05, 11 wells were sampled annually (appendix 2) using consistent sampling and analytical methods. These samples were collected only after 7 or more days without rainfall, and reporting levels were mostly 0.01 $\mu\text{g/L}$ or lower. Only results from this sampling period (2001–05) are discussed and summarized herein; other samples for 2004–05 also are discussed to improve interpretation.

Atrazine, prometon, and simazine were detected in 25 percent or more of samples collected during 2001–05 (fig. 1.3). Diazinon and sulfometuron were detected in fewer than 25 percent of samples, and imazethapyr, propiconazole, and tebuthiuron were each detected in one sample.

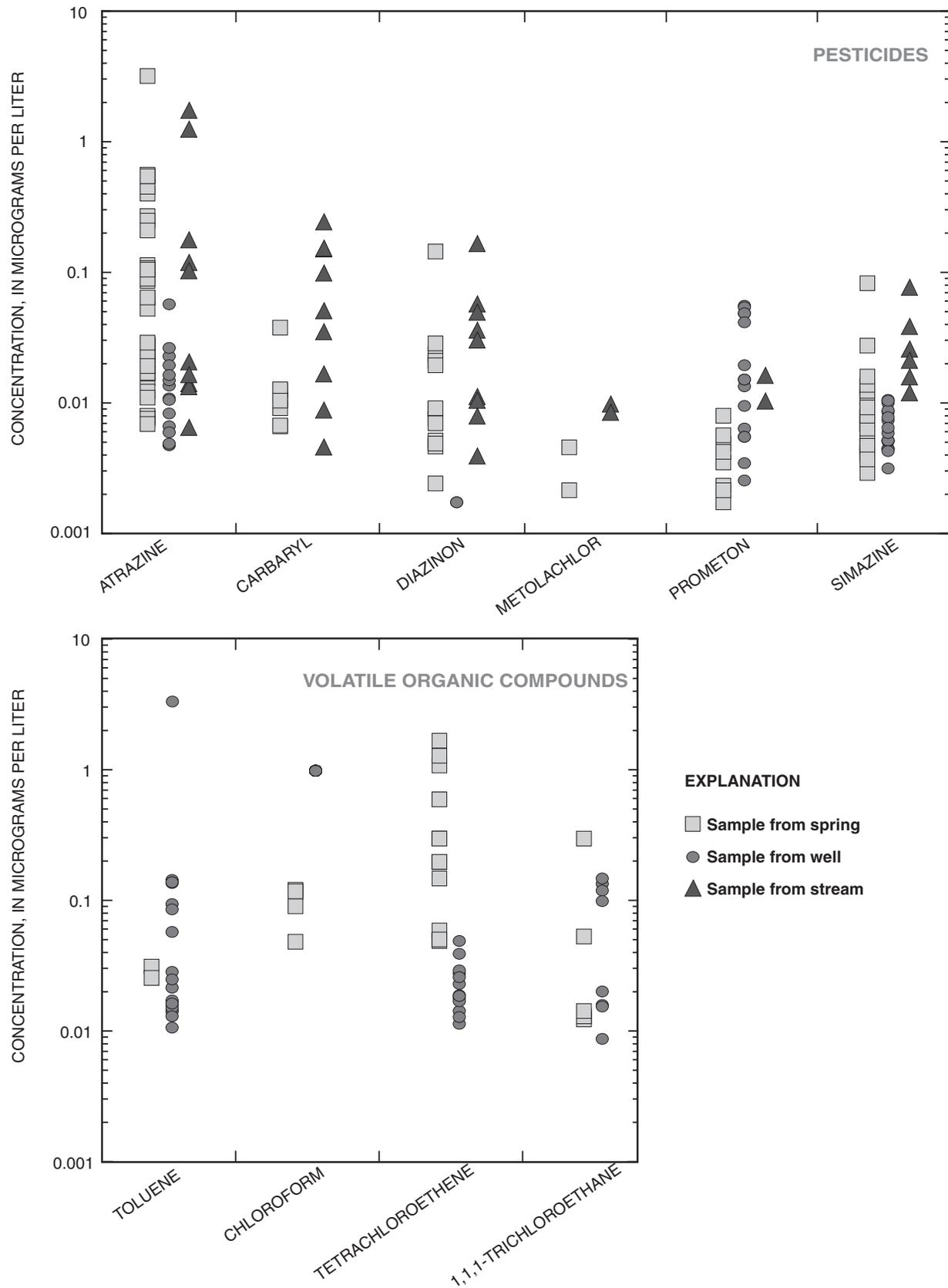


Figure 14. Concentrations of pesticides and volatile organic compounds detected in historical samples collected from streams, springs, and wells in the Barton Springs segment of the Edwards aquifer, Texas.

1–8 Recent (2003–05) Water Quality of Barton Springs, Austin, Texas, With Emphasis on Factors Affecting Variability

Table 1.1. Historical well sites sampled for pesticides and volatile organic compounds (VOCs) in the Barton Springs segment of the Edwards aquifer, Texas.

[USGS, U.S. Geological Survey; x, constituent sampled for; --, constituent not sampled for]

Site identifier ¹	USGS site identifier	State well number	Pesticides	VOCs
BDW	300646097533202	LR-58-57-311	x	x
BPS	300453097503301	LR-58-58-403	x	x
FON	301142097504701	YD-58-50-417	x	x
FOW	301031097515801	YD-58-50-408	x	x
GHW	300639097571001	LR-58-57-202	x	x
MCH	300813097512101	YD-58-50-704	x	x
PLS	301226097480701	YD-58-50-520	x	x
RAB	301526097463201	YD-58-42-915	x	x
SLE	300938097490601	YD-58-50-830	x	x
SVE	301356097473301	YD-58-50-216	x	x
SVN	301432097480001	YD-58-50-217	x	x
SVS	301339097483701	YD-58-50-215	x	x
SVW	301423097495901	YD-58-50-211	x	x
HKN	300356097563801	LR-58-57-502	x	--
PCE	301811097470401	YD-58-42-608	x	--
PHC	301604097465601	YD-58-42-913	x	--
WBG	300803097483801	YD-58-50-810	x	--
SLR	300847097545801	LR-58-49-903	--	x
SLS	300941097542201	LR-58-49-930	--	x
TNR	300646097533201	LR-58-57-303	--	x
ROL	301628097474001	YD-58-42-813	--	x
FMW	301106097520501	YD-58-50-412	--	x
HND	301113097485401	YD-58-50-502	--	x
KCH	301148097503501	YD-58-50-406	--	x

¹Site identifier derived from one or more parameters such as city name, geographic bearing from cities, well owner name, and well operator name.

Table 1.2. Pesticides detected at least once in samples from the Barton Springs segment of the Edwards aquifer, Texas (1978–2005).

[x, detection; --, nondetection]

Pesticide	Streams		Springs 2000 to 2003	Wells 2001 to 2005
	1978 to 2001	2002 to 2003		
Frequently detected pesticides¹				
Atrazine or degradate	x	x	x	x
Simazine	x	x	x	x
Diazinon	x	x	x	x
Prometon	x	x	x	x
Carbaryl	x	x	x	--
Metolachlor	x	x	x	--
Other detected pesticides¹				
Sulfometuron	--	x	--	x
Tebuthiuron	--	--	--	x
Imazethapyr	--	--	--	x
Propiconazole	--	--	--	x
2,4,5-T	x	--	--	--
Bromacil	x	--	--	--
Hexazinone	x	--	--	--
Chlorpyrifos	x	x	--	--
2,4-D	x	x	--	--
Malathion	x	x	--	--
Siduron	--	x	--	--
Triclopyr	--	x	--	--
Dacthal/DCPA	--	x	--	--
Dichlorprop	--	x	--	--
Diuron	--	x	--	--
Fipronil	--	x	--	--
Fluometuron	--	x	--	--
MCPA	--	x	--	--
Propyzamide	--	x	--	--
Propoxur	--	x	--	--
Alachlor	--	x	--	--
Benomyl	--	x	--	--

¹All compounds listed were analyzed for.

Pesticides were detected more frequently in samples from wells north of well SVS than in samples from wells south of well SVS (fig. 1.6; no detections at wells FON and MCH). Seventy-seven percent of all pesticide detections in well samples were from four wells (SVE, SVN, SVS, and SVW). Atrazine or one of its degradates were detected in 100 percent of samples from wells SVE and SVW, and atrazine and prometon were detected in 100 percent of samples from well SVS. Atrazine concentrations of 0.02 µg/L or higher occurred exclusively in samples from well SVW. Imazethapyr, propiconazole, and tebuthiuron were each detected once, in wells SVW, SVN, and SVS, respectively, and were not detected in samples from any other wells. Atrazine or one of its degradates was detected in samples from wells in all parts of the aquifer and was detected in samples from more wells than any other pesticide analyzed (nine of the 11 wells sampled) (fig. 1.6). Inconsistent with the general spatial pattern observed for pesticides, prometon was detected in all samples from well FOW at concentrations about twice those measured in samples from any other well, indicating that there is a localized source of prometon near this well.

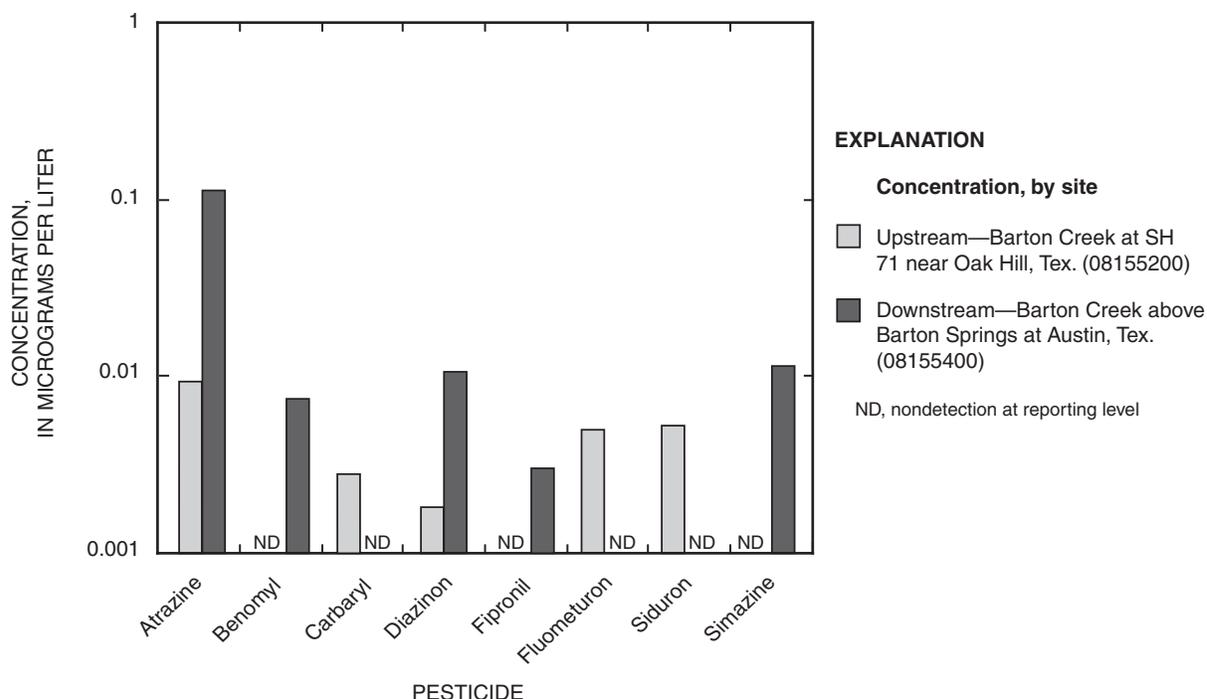


Figure 1.5. Comparison of median pesticide concentrations in historical stormflow samples from Barton Creek, Austin, Texas, from locations upstream and downstream of recharge zone, based on seven composite samples (2002).

Temporal trends in concentrations in samples from wells were tested using the nonparametric Kendall's tau test (Helsel and Hirsch, 1992), which measures the correlation between concentration and date on the basis of ranked data. Nondetections were ranked as lower than detections. There were no temporal trends that were statistically significant at p -values $< .1$, which is not surprising given the small data set ($n=5$ for each well) and the lack of knowledge of the short-term temporal variability of pesticide concentrations in wells.

Volatile Organic Compounds

Samples from Barton Springs (spring orifices) and 20 wells in the Barton Springs segment (table 1.1) were analyzed intermittently by the USGS for volatile organic compounds (VOCs) during 1985–2005. Samples were collected from Main Spring orifice three or four times a year during 1986–93 and once in 2002 and from Upper Spring orifice four times in 2002. Samples were collected intermittently from 20 wells beginning in 1985.

Nineteen VOCs were detected in samples from wells and eight of those 19 were detected in Barton Springs (table 1.3; complete data in appendix 2). Excluding tetrachloroethene from the analysis, 57 percent of VOC concentrations were less than $0.1 \mu\text{g/L}$ (fig. 1.4). All detections of tetrachloroethene in wells were at concentrations less than $0.1 \mu\text{g/L}$, but 12 of 16 detections of tetrachloroethene in samples from Barton Springs exceeded $0.1 \mu\text{g/L}$. This is likely because springs were sampled under stormflow conditions in some cases, whereas wells were not.

Volatile Organic Compounds in Spring Water

Thirty samples for VOC analysis were collected from Main Spring orifice intermittently during 1986–2002, and four samples for VOC analysis were collected from Upper Spring orifice in 2002. The number of compounds analyzed increased and the VOC reporting level decreased twice during this period (1986–2002). For the nine samples from Main Spring for which an analytical method with a high reporting level was used ($3 \mu\text{g/L}$), there were no detections out of a possible 305, therefore only results of the 21 samples from Main Spring analyzed using the lower reporting levels are discussed and summarized here. The four samples collected from Upper Spring orifice were analyzed using the same low reporting level method for the analysis of 85 VOCs.

1-10 Recent (2003-05) Water Quality of Barton Springs, Austin, Texas, With Emphasis on Factors Affecting Variability

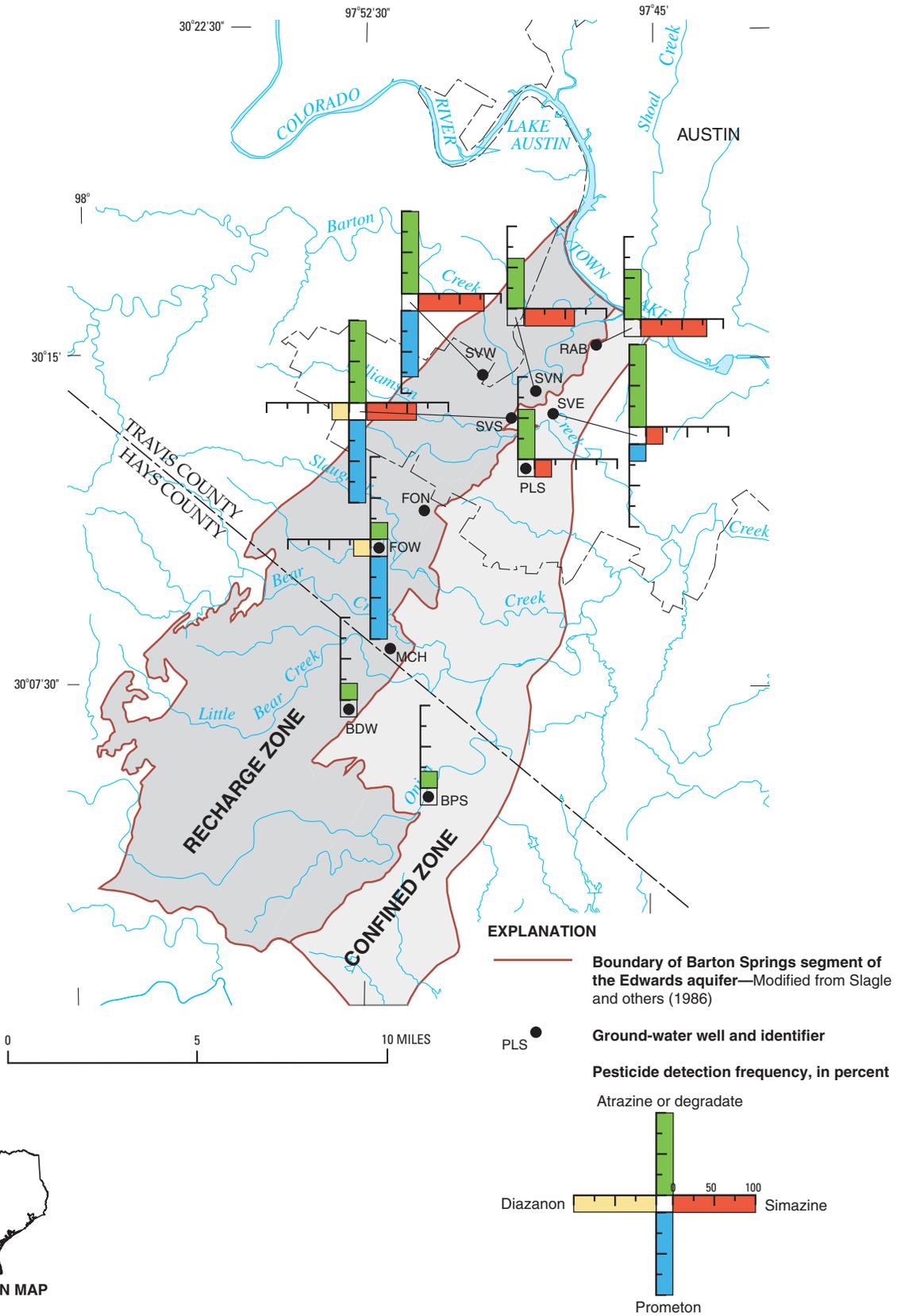


Figure 1.6. Detection frequency of selected pesticides in samples from wells in the Barton Springs segment of the Edwards aquifer, Texas (2001-05).

Eight VOCs were detected in samples from Main and Upper Springs (table 1.3). These eight VOCs are among 19 VOCs detected in the samples from wells. Of the 36 VOC detections in spring-water samples, 16 (44 percent) were for tetrachloroethene, eight (22 percent) were detections of trihalomethanes (THMs) (chloroform and bromodichloromethane), and five (14 percent) were detections of 1,1,1-trichloroethane. Tetrachloroethene was detected in 16 of the 25 samples analyzed (64 percent), had the maximum concentration of any VOC detected (1.7 µg/L), and had the highest median concentration of any of the VOCs (0.06 µg/L; all other VOCs were detected in less than one-half of the combined spring samples).

Upper and Main Springs had different patterns of VOC detections. In Main Spring, tetrachloroethene was the most frequently detected VOC and had the highest concentrations: it was detected in 12 of 21 samples (57 percent) analyzed using the low reporting level methods, had a maximum concentration of 1.7 µg/L, and had a median concentration of 0.20 µg/L. Other VOCs were detected infrequently (twice or less) or not at all. At Upper Spring, tetrachloroethene and chloroform were detected in all four samples collected, and 1,1,1-trichloroethane, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), and bromodichloromethane were detected in three of the four samples. These four samples all were collected in spring 2002, so they might reflect the ambient conditions for that period. Of the VOCs detected in Upper Spring, chloroform had the highest concentrations: both the maximum and median concentrations of chloroform detected were 0.12 µg/L; the median concentration of tetrachloroethene in Upper Spring was 0.05 µg/L, about four times lower than the median concentration of tetrachloroethene in Main Spring.

The only VOC for which temporal trends can be evaluated is tetrachloroethene in Main Spring. On the basis of a Kendall's tau non-parametric test for trends, there was no statistically significant temporal trend in tetrachloroethene concentrations.

Table 1.3. Volatile organic compounds (VOCs) detected at least once in samples from the Barton Springs segment of the Edwards aquifer, Texas (1986–2005)

[--, nondetection; x, detection].

VOC	Springs ¹	Wells ²
Gasoline constituents		
Ethylbenzene	--	x
Toluene	x	x
m-xylene + p-xylene	--	x
o-xylene	--	x
Drinking-water disinfection by-products (trihalomethanes)		
Chloroform	x	x
Bromodichloromethane	x	x
Dibromochloromethane	--	x
Tribromomethane	--	x
Industrial solvents		
1,1,1-Trichloroethane	x	x
Dichloromethane	x	x
Tetrachloroethene	x	x
Trichloroethene	x	x
Ethyl methyl ketone	--	x
Tetrahydrofuran	--	x
Other industrial compounds		
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	x	x
1,2-Dichloropropane	--	x
Acetone	--	x
Carbon disulfide	--	x
Styrene	--	x

¹Samples with low reporting levels (1986–2002).

²Samples with low reporting levels (1994 and 1995–96 [some samples] and 1998–2005).

Volatile Organic Compounds in Ground Water

Beginning in 1985, samples from wells were analyzed for 27 VOCs; the number of VOCs analyzed increased over time, and during 2000–2005, 88 VOCs were measured in 11 wells on an annual basis. During 1985–97, except for 1996, the analytical method used for the ground-water samples from wells had a reporting level of 3 µg/L for all compounds except vinyl chloride, which had a reporting level of 1 µg/L beginning in 1989. A reporting level of 3 µg/L is higher than about 97 percent of all historical reported detections of VOCs in wells in the Barton Springs segment. Of the 184 samples analyzed with this method (7,790 possible detections), there were only four detections of VOCs (0.05 percent). However, during 1994, 1995–96 (some samples), and 1998–2005, the reporting levels for most of the compounds analyzed were less than 0.5 µg/L, and many were less than 0.1 µg/L. Only results of the 104 samples analyzed using these lower reporting levels are discussed and summarized here. While not strictly “historical” data as defined by this report, samples for 2004–05 are included to improve the interpretation of the data set.

The VOCs detected in samples from wells were constituents of gasoline (benzene, toluene, ethylbenzene, and xylene, or BTEX compounds), drinking-water disinfection by-products (THMs), industrial solvents, and other industrial compounds (table 1.3). One or more of these compounds was detected in 13 of the 14 wells sampled using the lower reporting levels. Nineteen VOCs were detected at least once. The VOCs most frequently detected in the 104 samples analyzed were chloroform (a THM; 30 detections, or 29 percent), toluene (a BTEX compound; 20 detections, or 20 percent), and tetrachloroethene (a solvent; 13 detections, or 13 percent).

1-12 Recent (2003–05) Water Quality of Barton Springs, Austin, Texas, With Emphasis on Factors Affecting Variability

Toluene was the BTEX compound most frequently detected: 19 of the 22 detections of a BTEX compound were of toluene (86 percent). Toluene was detected in all parts of the Barton Springs segment. The upper quartile of concentration values was detected in samples from four wells in the northeastern part of the Barton Springs segment (RAB, SVN, SVS, SVW).

Chloroform was the THM most frequently detected: 30 of the 39 detections of a THM (77 percent) were of chloroform. Bromodichloromethane was detected seven times (18 percent of detections), and dibromochloromethane and tribromomethane were each detected once, in the same sample. That sample, collected in June 2004 from well MCH, also had the highest concentrations of chloroform and bromodichloromethane detected. THMs were detected in all parts of the Barton Springs segment, but most of the detections were in samples from four wells: MCH (detected in five of nine samples), SVE (detected in five of nine samples), SVN (detected in five of seven samples), and SVW (detected in nine of 10 samples). Three of these wells are in the northeastern part of the Barton Springs segment.

The industrial solvents most frequently detected were tetrachloroethene and 1,1,1-trichloroethane: 13 of the 30 detections of a solvent (43 percent) were of tetrachloroethene and eight of the 30 detections (27 percent) were of 1,1,1-trichloroethane. The highest concentration measured of the most frequently detected solvent, tetrachloroethene, was 0.05 mg/L. Solvents were most frequently detected in samples from wells in the northeastern part of the Barton Springs segment: 19 of the 30 detections of solvents (63 percent) were in samples from two wells in the northeastern part of the Barton Springs segment.

Other industrial compounds (13 detections) were detected less frequently than the three other groups of VOCs. The most frequently detected of other industrial compounds was Freon 113, which was detected five times (38 percent of detections of other industrial compounds). All of the Freon 113 detections were in samples from well SVS at concentrations ranging from 0.2 to 0.8 mg/L. The highest concentration measured of an industrial compound was 4.18 mg/L of acetone. The two other samples with detections of acetone had similarly elevated concentrations (3.65 and 2.08 mg/L); concentrations of the other industrial compounds did not exceed 0.14 mg/L. The three detections of acetone were flagged as estimated because each was below the reporting level of 6 mg/L; they occurred in samples from three wells (MCH, PLS, SVS) collected over a period of 3 days (May 25–27, 2005).

Similar to pesticides, samples collected annually during 2001–05 from 11 wells (fig. 1.7) were analyzed for the same suite of VOCs using the same reporting levels; these data therefore are available for evaluation of geographic and temporal trends. The VOCs most frequently detected in these 55 samples were chloroform (24 detections, or 44 percent), toluene (17 detections, or 31 percent), and tetrachloroethene (13 detections, or 24 percent).

The number of VOCs in samples with detections during 2001–05 ranged from one to eight, and ground water in the northern one-third of the Barton Springs segment was the most affected by VOCs. The highest number of detections per sample were in wells across the northern one-third of the Barton Springs segment from well SVE to SVS to SVW (fig. 1.7). The single site deviating from this pattern is well MCH in the central part of the Barton Springs segment, which had the second highest number of detections of the 11 wells. Chloroform was detected in every sample from wells MCH, SVE, SVN, and SVW. The median concentration in samples from well SVW was 0.26 µg/L, 6 times higher than the next highest median concentration, which was for samples from well SVN. Tetrachloroethene was detected in all five samples from well SVE, in three samples from well SVW, and in two samples from well SVS. It was not detected in any wells south of well FON or north of wells SVN and SVW. The solvent trichloroethene, which is a breakdown product of tetrachloroethene, was detected only at well SVW. Bromodichloromethane (a THM) was detected in four of the five samples from well SVW; the frequency of detection, accompanied by the ubiquitous and relatively high concentrations of chloroform detected in this well, indicate that contamination of ground water by drinking-water disinfection by-products is occurring in this area. Three of the five detections of the solvent 1,1,1-trichloroethane were in samples from well SVW. Freon 113 was detected only in the five samples from well SVS, with a maximum concentration of 0.8 µg/L and a median concentration of 0.4 µg/L.

Temporal trends were evaluated using the nonparametric Kendall's tau test (Helsel and Hirsch, 1992). Nondetections were ranked as lower than detections. There were no temporal trends that were statistically significant at p -values $< .1$, likely a result of the smaller data set ($n=5$ for each well) and the lack of knowledge of short-term temporal variability of the concentrations. A few temporal patterns, although not statistically significant, are of interest, as they suggest that statistically significant trends might appear with a larger or more robust data set. Toluene was not detected in samples collected from well FOW in 2001, 2002, and 2004 but was detected in samples collected in 2003 and 2005. Tetrachloroethene was not detected in samples collected from wells FON and PLS during 2001–04 but was detected in both wells in 2005. Trichloroethene was detected in samples collected from well SVW during 2001–03 but not detected in samples collected in 2004 and 2005. Acetone, which has a relatively high reporting level (6 or 7 µg/L for 2001–05), was detected for the first time in 2005 in three wells (MCH, PLS, SVS) at estimated concentrations of 2.1 to 4.2 µg/L.

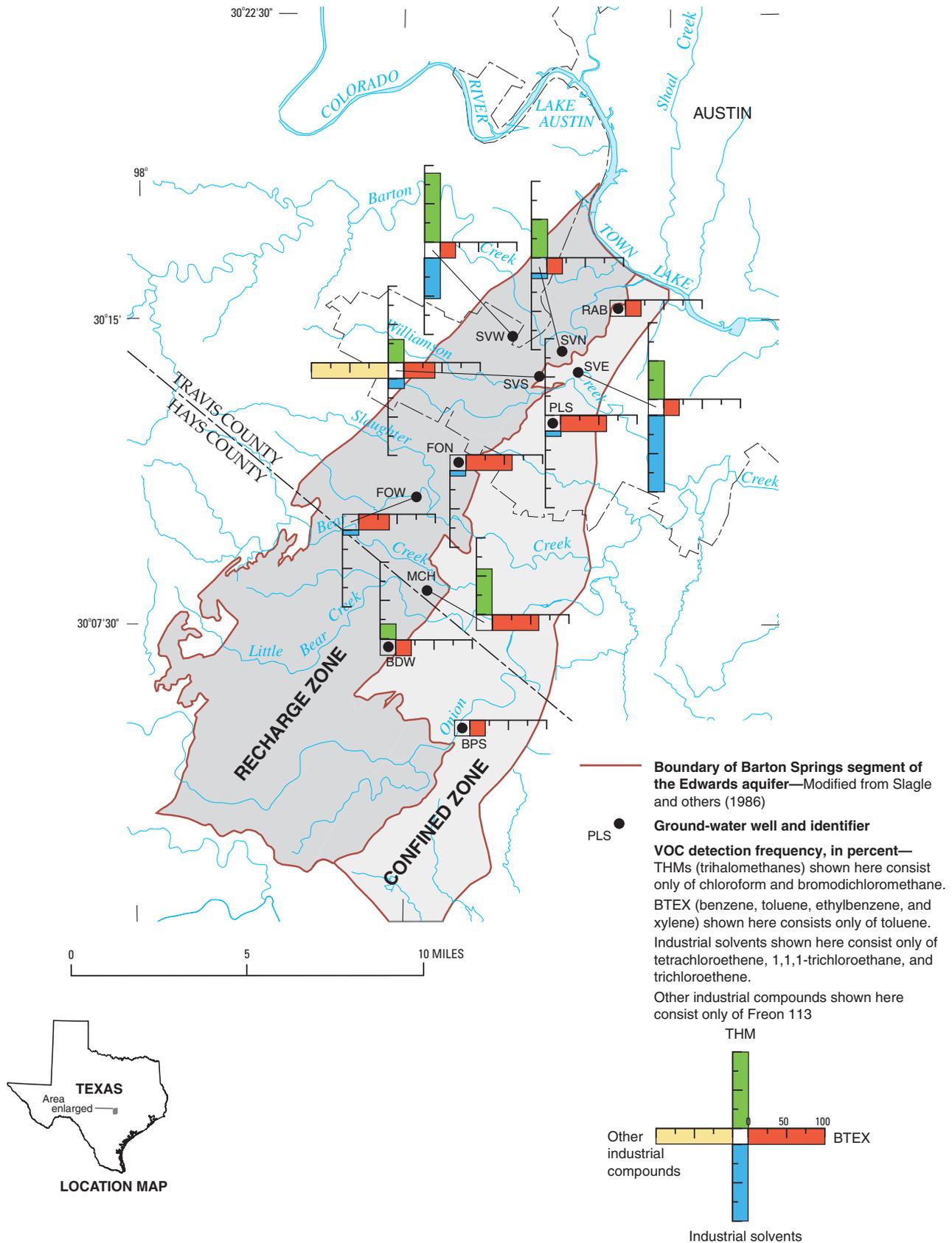


Figure 1.7. Detection frequency of selected volatile organic compounds (VOCs) in samples from wells in the Barton Springs segment of the Edwards aquifer, Texas (2001–05).